Career Technical Credit Transfer (CT)²
Air Transportation Career-Technical Assurance Guide (CTAG)
Created: March 4, 2015 (Updated June 2022)

The following programs/courses, indicated by a Career-Technical Articulation Number (CTAN), are eligible for transfer among Ohio's Public Secondary (CT)2 approved programs/courses and state institutions of higher education.

CTAIR001 - Air Transportation	**Credits: 3 Semester Hours**

Requirements for Credit:

- Matriculate to an institution of higher education with an approved or comparable program within 3 years after completing the approved secondary program
- Successfully complete both ODE secondary courses **Aviation Airport Management (177020) & Aviation (177013)** and earn a qualifying score on the corresponding End-of-Course examinations

CTAIR002 - Aircraft Ground Operations	**Credits: 3 Semester Hours**

Requirements for Credit:

- Matriculate to an institution of higher education with an approved or comparable program within 3 years after completing the approved secondary program
- Successfully complete ODE secondary course **Aviation Maintenance General (177014)** and earn a qualifying score on the corresponding End-of-Course examination

- Sending school must be approved by the Federal Aviation Regulations with Part 147 certification to be eligible to transfer credit to a Part 147 program. Students from sending schools that are not Part-147-certified can only transfer credit to a non-Part-147-certified institution that offers this content.

CTAIR003 - Aviation Meteorology **Credits: 3 Semester Hours**

Requirements for Credit:

- Matriculate to an institution of higher education with an approved or comparable program within 3 years after completing the approved secondary program
- Successfully complete ODE secondary course **Aviation Meteorology (177019)** and earn a qualifying score on the corresponding End-of-Course examination

CTAIR004 - Introduction to Aviation **Credits: 3 Semester Hours**

Requirements for Credit:

- Matriculate to an institution of higher education with an approved or comparable program within 3 years after completing the approved secondary program
- Successfully complete ODE secondary course **Aviation (177013)** and earn a qualifying score on the corresponding End-of-Course examination

CTAIR006 – Uncrewed Aircraft Systems **Credits: 3 Semester Hours**

Requirements for Credit:

- Matriculate to an institution of higher education with an approved or comparable program within 3 years after completing the approved secondary program
- Successfully complete ODE secondary course **Uncrewed Aircraft Systems (177024)** and earn a qualifying score on the corresponding End-of-Course examination

Accessing Credit:
Students that have met the requirements for credit for each CTAN will appear in the CTAV system that public colleges and universities access to award credit. Institutions must have the student's permission to officially post the CTAG to their transcript. Students can grant this permission as part of the WebXam. If a student did not grant permission as part of the WebXam, he or she will still need to confirm with colleges and universities that they want credit for the CTAG course.
Institutional Approval:
Secondary- Secondary institutions must have pathway approval from the Ohio Department of Education. Certificate of Affirmation assurances are now incorporated into the CTE-26 application process **Colleges/Universities-** Postsecondary institutions must submit course through CEMS for review and approval by a faculty panel.

1. CTAIR001 Air Transportation: CTAN alignment with the Tech Prep Air Transportation Pathway in the Career Field Technical Content Standards of the Ohio Department of Education. (ODE courses 177020 and 177013)

Semester Credit Hours: 3

Course Description: An in-depth look at air transportation with an emphasis on commercial air carrier operations. Topics include history and development of air transportation, air carrier operations, and regulation and control of air carriers.

Learning Outcomes:

1. *Demonstrate basic knowledge of the history, development, evolution, and current and future trends of air transportation.
2. *Demonstrate basic knowledge of the airport and NAS environment in the United States.
3. *Demonstrate an in-depth understanding of the structure and operation of air carriers.
4. *Demonstrate basic understanding of business aviation.
5. *Demonstrate basic knowledge of the regulatory environment governing air carriers in the United States.

***Indicates Essential Learning Outcome**

Learning Outcomes The student will be able to:	Outcomes and/or Competencies in ODE's REVISED Career Field Technical Content Standards
1. Demonstrate basic knowledge of the history, development, and current and future trends of air transportation	7.1.1 Describe aviation technology from its inception to the current industry, including future trends. 7.1.2 Describe major contributions and barriers to the development of aviation. 7.1.5 Describe the role and function of the Federal Aviation Administration (FAA). 7.1.6 Describe the major FAA categories of aircraft. 7.1.7 Describe the function of the fixed base operator (FBO) and its role in general aviation. 7.1.9 Describe classes of airspace and associated requirements and limitations. 7.7.1 Describe the principles of radar. 7.11.6 Describe the Notice to Air Missions (NOTAM) system and its use.
2. Demonstrate basic knowledge of the airport and NAS environment in the United States.	7.5.1 Describe the different types of controlled and uncontrolled airports within the United States. 7.5.2 Differentiate between towered and non-towered airports. 7.5.3 Identify features of airports and directional traffic patterns and interpret runway markings. 7.5.4 Identify lighting systems and explain their function. 7.5.5 Describe weather patterns and their impact on airport operations. 7.5.6 Describe noise abatement strategies and procedures. 7.7.1 Describe the principles of radar. 7.7.2 Describe the components of secondary radar. 7.7.3 Control aircraft departure, arrivals and ground operations from an airport tower. 7.7.4 Sequence aircraft approaches and departures with approach control radar. 7.7.5 Interpret weather for departures and arrivals. 7.7.6 Define the very high frequency (VHF) and ultra-high frequency (UHF) radio bands and how to access. 7.7.7 Describe radio communication, phraseology and light signals. 7.7.8 Describe the function of transponders. 7.7.9 Describe causes of lost communication and lost communication procedures.

3. Demonstrate an in-depth understanding of the structure and operation of air carriers.	1.2.10 Use interpersonal skills to provide group leadership, promote collaboration, and work in a team. 1.6.11. Describe how all business activities of an organization work within the parameters of a budget. 1.8.1. Forecast future resources and budgetary needs using financial documents (e.g., balance sheet, demand forecasting, financial ratios). 1.8.9. Develop a budget that reflects the strategies and goals of the organization. 7.1.3 Describe social and economic impacts that contribute to the movement of people and goods. 7.1.8. Differentiate between general aviation from commercial aviation. 7.4.5 Describe how aircraft configuration affects performance. 7.4.9 Describe the effects of loading, weight and balance on center of gravity and aircraft performance. 7.4.10 Describe the design and power features that affect aircraft stability, performance and limitations. 7.6.3 Explain the effects of temperature on weather. 7.6.6 Identify wind patterns based on weather systems. 7.6.12 Describe the types and impact of thunderstorms, tornados, microbursts and hurricanes. 7.6.13 Describe wind and wind effects (i.e. crosswind, tailwind, windshear, mountain wave). 7.6.14 Describe the types of icing and their effect on aviation. 7.8.1 Describe the extent of human factors in aircraft accidents. 7.11.8 Define and describe piloting requirements for special use airspace (SUA), special flight rules areas (SFRA), temporary flight restrictions (TFR), and other airspace areas. 7.12.1 Describe takeoffs, landings, and go-arounds. 7.13.1 Define and differentiate visual flight rules (VFR) and instrument flight rules (IFR). 7.13.21 Analyze the challenges of night operations.
4. Demonstrate a basic understanding of business aviation.	7.1.6 Describe the major FAA categories of aircraft. 7.1.8. Distinguish general aviation from commercial aviation. 8.1.1 Explain the knowledge, skill, experience and requirements to exercise the privileges of the aviation mechanic.
5. Demonstrate basic knowledge of the regulatory environment governing air carriers in the United States.	1.3.1. Analyze how regulatory compliance affects business operations and organizational performance 7.1.4 Describe the major legislative acts that have impacted aviation. 7.8.9. Describe the role of the National Transportation Safety Board (NTSB) in accident investigations.

	7.9.1 Describe regulatory requirements for certification, rating, inspection, reporting and compliance for small unmanned aircraft systems. 7.9.2 Describe registration requirements for small unmanned aircraft systems. 7.9.3 Describe operating rules for small unmanned aircraft systems. 7.9.4 Describe operating limitations for small unmanned aircraft systems. 7.9.5 Describe small unmanned aircraft waiver policy and requirements.

2. CTAIR002 Aircraft Ground Operations: CTAN alignment with the Tech Prep Air Transportation Pathway in the Career Field Technical Content Standards of the Ohio Department of Education. **(ODE course 177014**)

Semester Credit Hours: 3

Course Description: An introduction to aircraft maintenance ground operations and servicing. Students must demonstrate their knowledge and ability to correctly perform aircraft maintenance-related ground operations and aircraft servicing, and to properly use required technical manuals, technical data, publications, and forms.

Advising Notes:

- Sending school must be approved by the Federal Aviation Regulations with Part 147 certification to be eligible to transfer credit to a Part 147 program.
- Students from sending schools that are not Part 147 certificated can only transfer credit to a non-Part 147 certified institution that offers this content.

Learning Outcomes:

1. *Demonstrate, through written and oral examination, an in-depth understanding of various aircraft maintenance-related ground operations and procedures including:

a. *Aircraft ground towing and movement
b. *Aircraft parking and mooring
c. *Aircraft marshaling
d. *Ground vehicle operation
e. *Engine starting
f. *Engine operation
g. *Aircraft jacking and hoisting
h. *Aircraft servicing
i. *Aircraft cleaning

j. *Aircraft fuels and fueling
k. *Aircraft de-icing
l. *Ramp/flight line safety
m. *Hanger/shop safety
n. *Aircraft weight and balance assessment

2. *Perform various aircraft maintenance-related tasks and procedures for the following ground operations: a. *Aircraft ground towing and movement
b. *Aircraft parking and mooring
c. *Aircraft marshaling
d. *Ground vehicle operation
e. *Engine starting
f. *Engine operation
g. *Aircraft jacking and hoisting
h. *Aircraft servicing
i. *Aircraft fueling
j. *Aircraft de-icing
k. *Aircraft cleaning
l. *Determining aircraft weight and center of gravity

3. *Demonstrate, through written and oral examination, an understanding of the use of various required maintenance forms and records.
4. *Properly prepare required maintenance forms and records.
5. *Demonstrate, through written and oral examination, an understanding of the use of maintenance manuals and publications.
6. *Properly identify and use maintenance manuals and publications.

***** ***Indicates Essential Learning Outcome***

Learning Outcomes The student will be able to:	Outcomes and/or Competencies in ODE's REVISED Career Field Technical Content Standards
1. Demonstrate through written and/or oral examination an in-depth understanding of various aircraft maintenance-related ground operations and procedures including: • **aircraft ground towing and movement** • **aircraft parking and mooring** • **aircraft marshalling** • **ground vehicle operation** • **engine starting and operation** • **aircraft jacking and hoisting** • **aircraft servicing and cleaning** • **aircraft fuels and fueling** • **aircraft deicing** • **ramp/flight line safety** • **hangar/shop safety** • **aircraft weight & balance assessment**	1.2.1. Extract relevant, valid information from materials and cite sources of information. 8.3.7 Weigh aircraft 8.4.1 Start, ground operate, move, service, and secure aircraft and identify typical ground operation hazards. 8.4.2 Identify and select fuels. 8.4.3 Identify and select cleaning materials. 8.4.4 Inspect, identify, remove, and treat aircraft corrosion and perform aircraft cleaning. 7.5.3 Identify features of airports and directional traffic patterns and interpret runway markings. 7.7.7. Describe radio communication, phraseology and light signals. 7.11.17 Describe safe Taxiing (ASEL, AMEL).
2. Perform various aircraft maintenance-related tasks and procedures for the following ground operations: • **aircraft ground towing and movement** • **aircraft parking and mooring** • **aircraft marshalling** • **ground vehicle operation** • **engine starting and operation** • **aircraft jacking and hoisting** • **aircraft servicing and cleaning** • **aircraft fueling** • **aircraft deicing** • **determining aircraft weight and center of gravity**	1.1.1. Identify the knowledge, skills, and abilities necessary to succeed in careers. 1.2.12. Use technical writing skills to complete forms and create reports. 8.3.7 Weigh aircraft. 8.3.8 Perform a complete weight and balance check and record data. 8.4.1 Start, ground operate, move, service, and secure aircraft and identify typical ground operation hazards. 8.4.2 Identify and select fuels. 8.4.3 Identify and select cleaning materials. 8.4.4 Inspect, identify, remove, and treat aircraft corrosion and perform aircraft cleaning. 7.5.3. Identify features of airports and directional traffic patterns and interpret runway markings. 7.7.7. Describe radio communication, phraseology and light signals
3. Demonstrate through written and/or oral examination an understanding of the use of various required maintenance forms and records.	1.1.1. Identify the knowledge, skills, and abilities necessary to succeed in careers. 1.2.1. Extract relevant, valid information from materials and cite sources of information.

	1.2.12. Use technical writing skills to complete forms and create reports.
4. Properly prepare required maintenance forms and records.	1.2.1. Extract relevant, valid information from materials and cite sources of information. 1.2.12. Use technical writing skills to complete forms and create reports.
5. Properly identify and demonstrate through written and/or oral examination an understanding of the use of maintenance manuals and publications.	1.1.1 Identify the knowledge, skills, and abilities necessary to succeed in careers. 1.2.1. Extract relevant, valid information from materials and cite sources of information. 1.2.12. Use technical writing skills to complete forms and create reports.

3. CTAIR003 Aviation Meteorology: CTAN alignment with the Tech Prep Air Transportation Pathway in the Career Field Technical Content Standards of the Ohio Department of Education. **(ODE course 177019)**

Semester Credit Hours: 3

Course Description: Fundamental concepts of aviation meteorology. Topics include atmospheric properties and processes, basic weather theory, weather hazards to flight, and aviation weather information and services.

Learning Outcomes:

1. *Demonstrate basic knowledge of the structure and properties of the atmosphere.
2. *Demonstrate an understanding of the basic causes and characteristics of aviation weather.
3. *Demonstrate an understanding of aviation weather hazards and hazardous conditions.
4. *Describe the different types of aviation weather resources and services.
5. *Analyze and interpret different types of aviation weather forecasts, charts, and other weather reports to determine and predict flight conditions.

***** ***Indicates Essential Learning Outcome***

Learning Outcomes The student will be able to:	Outcomes and/or Competencies in ODE's REVISED Career Field Technical Content Standards
1. Demonstrate basic knowledge of the structure and properties of the atmosphere.	7.6.1 Identify the atmospheric layers and their composition. 7.6.2 Describe how atmospheric properties of pressure, condensation, evaporation, precipitation, and humidity affect atmospheric conditions and stability. 7.6.3 Explain the effects of temperature on weather. 7.6.4 Describe the effects of gravity, friction, and centripetal force on wind.
2. Demonstrate an understanding of the basic causes and characteristics of weather.	7.6.1 Identify the atmospheric layers and their composition 7.6.5 Explain the causes of atmospheric circulation. 7.6.6 Identify wind patterns based on weather systems. 7.6.7 Describe factors related to stability (e.g., clouds, fronts, air masses, precipitation). 7.6.8 Describe the causes and effects of temperature inversions. 7.6.10 Describe cycles of moisture and associated precipitation and temperature related phenomena.
3. Demonstrate an understanding of aviation weather hazards and hazardous conditions.	7.6.11 Describe the types, conditions, and factors of turbulence. 7.6.12 Describe the types and impact of thunderstorms, tornados, microbursts and hurricanes. 7.6.13 Describe wind and wind effects (i.e., crosswind, tailwind, windshear, mountain wave). 7.6.14 Describe the types of icing and their effect on aviation. 7.6.9 Describe weather system formation, including air masses and fronts. 7.11.3 Describe weather and environmental obstructions to visibility (e.g., smoke, haze, volcanic ash). 7.11.11 Describe atmospheric conditions affecting performance.
4. Describe, analyze and interpret different types of aviation weather forecasts, charts, and other weather reports to determine and predict flight conditions.	7.7.5 Interpret weather for departures and arrivals. 7.11.4 Describe weather products and resources required for preflight planning, current and forecast weather for departure, en route, and arrival phases of flight.
5. Analyze and interpret different types of aviation weather forecasts, charts, and other weather reports to determine and predict flight conditions.	7.11.4 Describe weather products and resources required for preflight planning, current and forecast weather for departure, en route, and arrival phases of flight.

4. CTAIR004 Introduction to Aviation: CTAN alignment with the Tech Prep Air Transportation Pathway in the Career Field Technical Content Standards of the Ohio Department of Education. **(ODE Course 177013)**

Semester Credit Hours: 3

Course Description: An overview of the history, development, and evolution of aeronautics and aviation. Course also explains the national aviation system in the United States, describes different sectors of the aviation industry, and explores various opportunities and career paths in aviation.

Learning Outcomes:

1. *Demonstrate basic knowledge of the history, development, and evolution of aviation.
2. *Demonstrate basic knowledge of different sectors of the air transportation industry.
3. *Demonstrate basic knowledge of the airport environment in the United States.
4. *Demonstrate basic knowledge of the NAS and the air traffic control system in the United States.
5. *Demonstrate basic knowledge of aviation industry career specialties, opportunities, and trade/professional organizations.
6. *Demonstrate basic knowledge of the manufacturing and maintenance industries for military, commercial, and general aviation aircraft.
7. *Demonstrate basic knowledge of aerodynamics and the forces of flight.

Indicates Essential Learning Outcome

Learning Outcomes **The student will be able to:**	**Outcomes and/or Competencies in ODE's REVISED Career Field Technical Content Standards**
1. Demonstrate basic knowledge of the history, development, and evolution of aviation	7.1.1. Describe aviation technology from its inception to the current industry, including future trends. 7.1.2 Describe contributions and barriers to the development of aviation. 7.1.6. Describe the major FAA categories of aircraft.

2. Demonstrate basic knowledge of different sectors of the air transportation industry	7.1.1. Describe aviation technology from its inception to the current industry, including future trends. 7.1.3 Describe social and economic impacts that contribute to the movement of people and goods. 7.1.5 Describe the role and function of the Federal Aviation Administration (FAA). 7.1.6. Describe the major FAA categories of aircraft. 7.1.7 Describe the function of the fixed base operator (FBO) and its role in general aviation. 7.1.8. Differentiate between general and commercial aviation. 7.1.9. Describe classes of airspace and associated requirements and limitations.
3. Demonstrate basic knowledge of the airport environment in the United States.	7.5.1 Describe the different types of controlled and uncontrolled airports within the United States. 7.5.2 Differentiate between towered and non-towered airports.
4. Demonstrate basic knowledge of the NAS and the air traffic control system in the United States.	7.8.1 Describe the extent of human factors in aircraft accidents. 7.8.8 Describe the impact of cockpit automation on human error. 7.8.9 Describe the role of the National Transportation Safety Board (NTSB) in accident investigations.
5. Demonstrate basic knowledge of aviation industry career specialties, opportunities, and trade/professional organizations.	1.1.2. Identify the scope of career opportunities and the requirements for education, training, certification, licensure, and experience. 1.1.4. Describe the role and function of professional organizations, industry associations, and organized labor and use networking techniques to develop and maintain professional relationships. 1.3.1. Analyze how regulatory compliance affects business operations and organizational performance. 7.11.1 Describe pilot qualifications.
6. Demonstrate basic knowledge of the manufacturing and maintenance industries for military, commercial, and general aviation aircraft.	1.1.4. Describe the role and function of professional organizations, industry associations, and organized labor and use networking techniques to develop and maintain professional relationships.

7. Demonstrate basic knowledge of aerodynamics and the forces of flight.	7.4.1 Compare and contrast aeronautics and aerodynamics. 7.4.2 Describe the forces of flight and the three axes of motion. 7.4.3 Define Newton's Laws of Motion and Bernoulli's Principle. 7.4.4 Identify the parts of an airfoil and describe how an airfoil works. 7.4.5 Describe how aircraft configuration affects performance. 7.4.6 Discuss the role of thrust and the relationship between lift and drag. 7.4.7 Describe lateral and directional stability and the parts of the aircraft that control the aircraft. 7.4.9 Describe the effects of loading, weight and balance on center of gravity and aircraft performance. 7.4.10 Describe the design and power features that affect aircraft stability, performance and limitations. 7.11.2 Describe airworthiness requirements.

CTAIR006 Uncrewed Aircraft Systems: CTAN alignment with the Tech Prep Air Transportation Pathway in the Career Field Technical Content Standards of the Ohio Department of Education. (ODE course:177024)

Semester Credit Hours: 3

Course Description: The Uncrewed Aircraft Systems (UAS) course will provide an opportunity to learn about careers utilizing UAS, exploration of industries where UAS can be utilized, and the opportunity to earn a FAA Part 107 Remote Pilot certificate.

Learning Outcomes:

1. *Demonstrate a basic understanding of weather theory, hazardous weather situations, wind shear avoidance, and the procurement and use of graphical and textual weather products in order to identify current conditions and short-term forecasts.
2. *Demonstrate basic knowledge of the Federal Aviation Regulations that relate to Remote Pilot in command privileges, limitations, and flight operations.
3. *Demonstrate the ability to interrupt aeronautical charts in order to identify airspace classification, airport locations, obstructions, and other hazards that may affect a UAS flight
4. *Identify the need for permission to fly in certain types of airspace and be able to utilize the appropriate systems to obtain those permissions
5. *Recognize when a waiver is needed for a flight, and understand the process to seek a waiver from the FAA
6. *Demonstrate an understanding of the aerodynamics that allow a UAS to fly, and how the shape and size of a UAS can change aerodynamic elements; identify sensor types and capabilities
7. *Demonstrate a basic knowledge of the performance limitations of UASs, and how to properly plan and conduct a flight within those limitations (weight and balance)
8. *Identify when crew resource management (CRM) and single pilot resource management (SRM) is essential to a flight, and describe the elements of effective CRM and SRM, including proper radios phraseology.

9. *Describe how safe, effective decisions pertain to a UAS flight, and how hazardous attitudes can degrade safety; ADM, PAVE, IM SAFE
10. *Demonstrate an understanding of the UAS industry and how their inclusion across multiple industries can lead to career opportunities
11. *Describe the ability to effectively pilot a UAS, and the process involved to initiate, conduct and terminate the flight safely
12. *Describe a basic understanding of preflight inspection, maintenance, and troubleshooting

Indicates Essential Learning Outcome

Learning Outcomes **The student will be able to:**	**Outcomes and/or Competencies in ODE's REVISED Career Field Technical Content Standards**
1. Demonstrate a basic understanding of weather theory, hazardous weather situations, wind shear avoidance, and the procurement and use of graphical and textual weather products in order to identify current conditions and short-term forecasts.	7.5.5 Describe weather patterns and their impact on airport operations. 7.6.3 Explain the effects of temperature on weather. 7.6.6 Identify wind patterns based on weather systems. 7.6.11 Describe the types, conditions and factors of turbulence. 7.6.12 Describe the types and impact of thunderstorms, tornados, microbursts and hurricanes. 7.6.13 Describe wind and wind effects (i.e. crosswind, tailwind, windshear, mountain wave). 7.6.9 Describe weather system formation, including air masses and fronts. 7.11.3 Describe weather and environmental obstructions to visibility (e.g., smoke, haze, volcanic ash). 7.11.5 Describe potential flight hazards
2. Demonstrate basic knowledge of the Federal Aviation Regulations that relate to Remote Pilot in command privileges, limitations, and flight operations.	7.1.5 Describe the role and function of the Federal Aviation Administration (FAA). 7.9.1 Describe regulatory requirements for certification, rating, inspection, reporting and compliance for small-unmanned aircraft systems. 7.9.2 Describe registration requirements for small-unmanned aircraft systems. 7.9.3 Describe operating rules for small-unmanned aircraft systems. 7.11.1 Describe pilot qualifications.
3. Demonstrate the ability to interrupt aeronautical charts in order to identify airspace classification, airport locations, obstructions, and other hazards that may affect a UAS flight	7.1.9 Describe classes of airspace and associated requirements and limitations. 7.5.1 Describe the different types of controlled and uncontrolled airports within the United States. 7.5.2 Differentiate between towered and non-towered airports. 7.11.6 Describe the Notice to Air Missions (NOTAM) system and its use. 7.11.8 Define and describe piloting requirements for special use airspace (SUA), special flight rules areas (SFRA), temporary flight restrictions (TFR), and other airspace areas.

4. Identify the need for permission to fly in certain types of airspace and be able to utilize the appropriate systems to obtain those permissions	7.13.2 Determine right of way and describe minimum safe altitude rules.
5. Recognize when a waiver is needed for a flight, and understand the process to seek a waiver from the FAA	7.9.5 Describe small-unmanned aircraft waiver policy and requirements. 7.13.20 Analyze the challenges of night operations.
6. Demonstrate an understanding of the aerodynamics that allow a UAS to fly, and how the shape and size of a UAS can change aerodynamic elements; identify sensor types and capabilities	7.4.2 Describe the forces of flight and the three axes of motion. 7.4.3 Define Newton's Laws of Motion and Bernoulli's Principle. 7.4.4 Identify the parts of an airfoil and describe how an airfoil works. 7.4.5 Describe how aircraft configuration affects performance. 7.4.6 Discuss the role of thrust and the relationship between lift and drag.
7. Demonstrate a basic knowledge of the performance limitations of UASs, and how to properly plan and conduct a flight within those limitations (weight and balance)	7.4.9 Describe the effects of loading, weight and balance on center of gravity and aircraft performance. 7.4.10 Describe the design and power features that affect aircraft stability, performance and limitations. 7.4.16 Define load factor and G-forces. 7.9.4 Describe operating limitations for small-unmanned aircraft systems. 7.11.9 Calculate performance and limitations. 7.11.10 Determine performance and limitations by the use of charts, tables, and data. 7.11.11 Describe atmospheric conditions affecting performance. 7.11.12 Describe how pilot technique and airport environment affect aircraft performance and limitations. 7.14.14 Describe characteristics and potential hazards of batteries or other fuel sources.

8. Identify when crew resource management (CRM) and single pilot resource management (SRM) is essential to a flight, and describe the elements of effective CRM and SRM, including proper radios phraseology.	7.7.7 Describe radio communication, phraseology and light signals. 7.9.6 Determine required crew roles (CRM, SRM) 7.9.7 Describe the purpose of visual observers, control stations and autonomous operations. 7.9.8 Describe pre-flight, in-flight and post-flight communications procedures.
9. Describe how safe, effective decisions pertain to a UAS flight, and how hazardous attitudes can degrade safety; ADM, PAVE, IM SAFE	7.8.2 Identify hazardous attitudes of flight. 7.8.6 Describe the decision-making process in flight and steps to break the chain of poor judgement. 7.14.1 Describe emergency operations. 7.14.4 Describe systems and equipment malfunctions. 7.14.15 Describe loss of aircraft control link and fly-a-ways. 7.14.16 Describe loss of Global Positioning System (GPS) signal during flight and potential consequences
10. Demonstrate an understanding of the UAS industry and how their inclusion across multiple industries can lead to career opportunities	1.1.1 Identify the knowledge, skills and abilities necessary to succeed in careers. 1.1.2 Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience. 1.6.1 Identify business opportunities.
11. Describe the ability to effectively pilot a UAS, and the process involved to initiate, conduct and terminate the flight safely	7.11.14 Perform and analyze a preflight assessment. 7.11.16 Demonstrate proper engine starting. 7.11.18 Perform a before takeoff check. 7.12.1 Describe takeoffs, landings, and go-arounds. 7.12.2 Demonstrate a normal takeoff and climb. 7.12.3 Demonstrate a normal approach and landing. 7.12.10 Demonstrate post-flight procedures. 7.14.2 Demonstrate emergency descent.
12. Describe a basic understanding of preflight inspection, maintenance, and troubleshooting	7.11.2 Explain airworthiness requirements. 7.11.13 Describe operation of systems. 7.11.14 Perform and analyze a preflight assessment. 7.14.14 Describe characteristics and potential hazards of batteries and other fuel sources.

Each CTAN identifies the learning outcomes that are equivalent or common in introductory technical courses. In order for students to be able to receive credit under these agreements, the career-technical programs and the state institutions of higher education must document that their course/program content matches the learning outcomes in the CTANs. In accordance with Ohio Revised Code 3333.162, industry standards and certifications provide documentation of student learning.

Requirements and Credit Conditions:

1. The receiving institution must have a comparable program, major, or courses that have been approved through submission to the Ohio Department of Higher Education $(CT)^2$ approval process for the CTANs listed in this document.
2. Credits apply to courses in the specified technical area at Ohio's Public Institutions of Higher Education, provided that the institution offers courses in the specific technical area. In the absence of an equivalent course, and when the institution offers the technical program, the receiving institution will guarantee to grant and apply an equivalent credit value of the Career-Technical Articulation Number (CTAN) toward the technical requirements of the specific degree/certificate program.
3. The applicant must provide proof to the receiving institution that the student completed a course or program that has been approved through the $(CT)^2$ approval process and that the student holds the appropriate credential.
4. A career-technical student seeking credit under the terms of this CTAG must enroll and submit their verification form to the college within three years of completing a career-technical course. Students may earn credit within the currency of the industry certificate or license.
5. A career-technical student who meets all eligibility criteria will receive the credit hour value for the comparable course(s) as offered at the receiving state institution of higher education.
6. The admission requirements of individual institutions and/or programs are unaffected by the implementation of $(CT)^2$ outcomes.
7. The transfer of credit through this CTAG will not exempt a student from the residency requirements at the receiving institution.

Revision Panel Participants
2021-2022

Brian Strzempkowski	The Ohio State University	Panel Lead Expert
Michael Ferguson	Bowling Green State University	Panel Expert
Gregory Garmin	Sinclair Community College	Panel Expert
Jason Loren	Kent State University	Panel Expert
Joseph Schaefer	Sinclair Community College	Panel Expert
Benjamin Sears	Sinclair Community College	Panel Expert
Chris Strausbaugh	The Ohio State University	Panel Expert
Nikki Wearly	Ohio Department of Higher Education	Director of Career-Technical Education Transfer Initiatives
Kristi Conrad	Ohio Department of Higher Education	Senior Associate Director, SCTAI

Air Transportation Panel Participants
Fall 2014

Dr. John Duncan	Kent State University	SCTAI Panel Lead Expert
Dr. Royce Ann Martin	Bowling Green State University	SCTAI Panel Expert
Mark Reed	Columbus State Community College	SCTAI Panel Expert
James Schmid	Cincinnati State Technical and Community College	SCTAI Panel Expert
Kent Wingate	Sinclair Community College	SCTAI Panel Expert
Jeff Gruber	Columbus State Community College	Item Writer
Don Stark	Sinclair Community College	Item Writer
Brian Strzempkowski	The Ohio State University	Item Writer
Brad Early	The Ohio State University	Item Writer
Dale Gelter	The Ohio State University	Item Writer
Doug Hammon	The Ohio State University	Item Writer
Jim Opperman	The Ohio State University	Item Writer
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